FUJITSU Software
Interstage Information Integrator V11

An Innovative WAN optimization solution to bring out maximum network performance

December, 2014
Fujitsu Limited
Overview

- WAN optimization solution overview
- FUJITSU Software for WAN optimization
- Key features
- Total WAN optimization solution
- Performance benchmark
**WAN optimization solution overview**

**Challenges**
- WAN’s characteristics
  - Low bandwidth
  - High latency
  - Packet Loss

**Issues**
- Slow application performance
- Poor user experience and low productivity
- Manage servers in branch offices

**Solution**
- Overcome both latency and packet loss problems in Wide Area Network
- Accelerate data transmission speed
- Deliver LAN-like performance to branch offices across the globe

**Benefits**
- Accelerate the performance of centrally hosted applications
- Improve user experience and boost productivity
- Avoid expensive WAN upgrades and reduce network costs
- Enable key IT initiatives using cloud

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FUJITSU Software for WAN optimization

FUJITSU Interstage Information Integrator V11

An Innovative WAN optimization solution to bring out maximum network performance

- Software-based WAN optimization solution
  - Key optimization method: protocol conversion
  - Convert TCP to Fujitsu patented proprietary high-performance protocol
    - Random Parity Stream (RPS)
    - Universal Network Acceleration Protocol (UNAP)
Key features

- **Innovative technologies**
  - **Random Parity Stream (RPS):** [patent-protected]
    - Patented technology for UDP to recover missing data when packets lost
  - **Universal Network Acceleration Protocol (UNAP):** [patent-pending]
    - UDP-based high-performance protocol with proprietary technologies that control unnecessary packet retransmission
  - **Reconfigurable-Transport (R-TSP):** [patent-pending]
    - Dynamic protocol selection technology

- **Support for a broad range of applications**
  - File sharing, Web, Collaboration, Backup, VDI, Unified communications, etc.

- **Complete network security**
  - Integrated AES encryption algorithm
  - No cached data on local storage

- **Quick and flexible deployment**
  - Can be placed on existing server due to Software-based WAN optimization
  - No need to change network structure (No cabling)
Avoid expensive WAN upgrades and reduce network costs

Comprehensive platform support from wireless clients to large-scale datacenters

Total WAN optimization solution

- Headquarter / Datacenter
  - Web, Collaboration, VDI, ERP, CRM, SCM, File server, etc.
  - Interstage Information Integrator

- Branch Office
  - Interstage Information Integrator

- Public Cloud
  - Backup, etc.
  - Interstage Information Integrator

- Wireless environment
  - Smartphone, Tablet, Notebook
  - III Client

- High-speed network

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Key technologies

- Issues with traditional TCP / UDP
- Fujitsu WAN optimization technologies
  - RPS (Random Parity Stream)
  - UNAP (Universal Network Acceleration Protocol)
  - R-TSP (Reconfigurable Transport)
  - Dynamic Bandwidth Control
Issues with traditional TCP

Pros: good transfer quality
Cons: poor transfer speed

- **Issue with bulk data transfer**

  ![Diagram of data transfer]

  - Sender
  - Data
  - ACK
  - Data
  - ACK
  - Data
  - ACK

  Acknowledgement (“ACK”) returned upon receipt of packet data

  **Issue (1)**
  More volume of data sent, more acknowledgements returned. This process consumes significant time.

  Longer RTT (Round Trip Time) takes more time spent for acknowledgements

- **Issue with distant communication**

  ![Diagram of data transfer]

  - Sender
  - Data
  - ACK
  - Data
  - ACK
  - Data
  - ACK

  Network performance drops due to time spent for ACK to reach to the sender

  **Issue (2)**
  Longer RTT takes, more speed drops

Pros: good transfer quality
Cons: poor transfer speed
Issues on traditional UDP

Pros: good transfer speed  Cons: unreliable, line gets occupied

- **Issue with reliability of data-transfer**

  **Issue (3)**
  Unlike TCP, UDP returns no acknowledgement. Therefore, the sender cannot notice any packet loss/mixed-up

  **(3) Packet mixed-up**

  **(3) Packet loss**

  **(4) Line is occupied by UDP traffic**

  **Issue (4)**
  UDP traffic occupies whole network bandwidth. Other traffic has to wait for its data-transfer.
## Fujitsu WAN optimization technologies

<table>
<thead>
<tr>
<th>Type</th>
<th>Technology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>High-performance Protocol</strong></td>
<td><strong>Random Parity Stream (RPS)</strong></td>
<td>Patented technology for UDP to recover missing data when packets lost</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>patent-protected</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Universal Network Acceleration Protocol (UNAP)</strong></td>
<td>UDP-based high-performance protocol with proprietary technologies to control unnecessary packet retransmission</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>patent-pending</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Reconfigurable-Transport (R-TSP)</strong></td>
<td>Dynamic protocol selection technology to measure and analyze network conditions in real time and dynamically select the most suitable communication method</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>patent-pending</strong></td>
</tr>
<tr>
<td><strong>Quality Management</strong></td>
<td><strong>Dynamic Bandwidth Control</strong></td>
<td>Control consuming bandwidth dynamically</td>
</tr>
<tr>
<td><strong>Transmission Speed Control</strong></td>
<td><strong>Data Encryption</strong></td>
<td>Encrypt data on network (AES:128bit)</td>
</tr>
<tr>
<td><strong>Security</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RPS (Random Parity Stream)

- Patented technology for UDP
  - Create redundant data when it is encoded
    - Redundant data size is less than 10% of data
  - If the packet is lost, it can restore any data using redundant data
  - Avoid packet retransmission

![Diagram of RPS (Random Parity Stream)]
**UNAP (Universal Network Acceleration Protocol)**

- UDP-based high-performance protocol with proprietary technologies
  - Identify the reason why there may be a delay in delivery
    - packet loss, or temporary congestion on the network
  - If it determines the reason is packet loss, it will then retransmit the lost packet
  - Control unnecessary packet retransmission

---

Sender

**Data 1**

4 3 2 1

**Data 2**

8 7 6 5 12 11 10 9

Determine the necessity of packet retransmission

---

Receiver

Packet Loss

8 6 5 12 11 10 9

Resend request

7

---

Determine the necessity of packet retransmission

---
Fujitsu Develops New Data Transfer Protocol Enabling Improved Transmissions Speeds

Software-only approach enables over 30 times improvement in file transfer speeds between Japan and the US, reduces virtual desktop operating latency to less than 1/6 of previous levels

Kawasaki, Japan, January 29, 2013 — Fujitsu Laboratories Limited today announced the development of a new data transfer protocol that, by taking a software-only approach, can significantly improve the performance of file transfers, virtual desktops and other various communications applications.

Conventionally, when using transmission control protocol (TCP)\(^{(1)}\)—the standard protocol employed in communications applications—in a low-quality communications environment, such as when connected to a wireless network or during times of line congestion, data loss (packet loss) can occur, leading to significant drops in transmission performance due to increased latency from having to retransmit data.
R-TSP (Reconfigurable Transport)

- Automatically selects the most suitable protocol (UNAP, UDP+RPS, TCP) based on the application and network properties (bandwidth, packet loss rate, latency, RTT, etc.)
- Guarantees the best access for each application flow and maximizes application performance
Dynamic Bandwidth Control

- Regularly checks the status of the network and actively controls the bandwidth
- Minimizes the impact on other important traffic and utilizes existing network bandwidth in the most efficient way
Dynamic Bandwidth Control

Without bandwidth control

Other traffic is interrupted

Static bandwidth control

Control bandwidth to minimize an impact on other important traffic

Dynamic bandwidth control

Automatically check bandwidth availability at defined interval

Dynamically control bandwidth to utilize maximum bandwidth while minimizing an impact on other important traffic
Supported network characteristics

- Network type and effectiveness
- Applicable protocol diagram
- Protocol performance comparison
Network type and effectiveness

### Applicable network type and technology
- Broadband internet, Wireless networks, Satellite networks, Leased line, IPsec-VPN
  - SSL-VPN is not supported

<table>
<thead>
<tr>
<th>1</th>
<th>Factor</th>
<th>Effectiveness of III WAN optimization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>1</td>
<td>Round Trip Time (RTT) (ms)</td>
<td>40</td>
</tr>
<tr>
<td>2</td>
<td>Packet loss rate (%)</td>
<td>0.01</td>
</tr>
<tr>
<td>3</td>
<td>Bandwidth (Mbps)</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Transfer data size (MB)</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>Application type</td>
<td>Chatter application with frequent communication</td>
</tr>
</tbody>
</table>
Example cases and performance benchmarks

- Applicable applications
- Backup
- Enterprise Content Management
- Secured Delivery System
- Virtual Desktop Infrastructure
- Wireless environment
## Applicable application example

<table>
<thead>
<tr>
<th>Type</th>
<th>Application (Protocol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>File Sharing</td>
<td>Windows (CIFS)</td>
</tr>
<tr>
<td>Web</td>
<td>Web-based applications (HTTP / HTTPS) for file downloading/uploading</td>
</tr>
<tr>
<td>File Transfer Software</td>
<td>HULFT 7 (Japan only)</td>
</tr>
<tr>
<td>Backup / Replication</td>
<td>Backup and replication applications from leading vendors</td>
</tr>
<tr>
<td>CAD</td>
<td>FTCP Remote Desktop (Japan only)</td>
</tr>
<tr>
<td>Remote Desktop</td>
<td>Windows RDP, Citrix XenDesktop(*1)</td>
</tr>
</tbody>
</table>

*1: Citrix XenDesktop with DHCP mode is not supported
Data backup from primary datacenter to secondary datacenter

International WAN: Europe – Japan
- Bandwidth: 100Mbps, Latency: 250ms, Loss rate: 0.1%

Benchmark Result

<table>
<thead>
<tr>
<th>File size</th>
<th>Without III</th>
<th>With III</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backup</td>
<td>10 GB</td>
<td>7 hours 20 min</td>
<td>20 min</td>
</tr>
</tbody>
</table>
Delivery of Technical information and documents

Office, USA

Interstage Information Integrator

WAN (Internet)

15Mbps

100Mbps

Datacenter, Japan

Interstage Information Integrator

Enterprise Content Management System

Benchmark Result

International WAN: USA - Japan

Bandwidth: 15Mbps, RTT: 250ms

maximum 27x faster

<table>
<thead>
<tr>
<th>File size</th>
<th>Without III</th>
<th>With III</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upload</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 MB</td>
<td>9 sec</td>
<td>1 sec</td>
<td>9x faster</td>
</tr>
<tr>
<td>30 MB</td>
<td>180 sec</td>
<td>7 sec</td>
<td>26x faster</td>
</tr>
<tr>
<td>Download</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 MB</td>
<td>13 sec</td>
<td>1.5 sec</td>
<td>9x faster</td>
</tr>
<tr>
<td>30 MB</td>
<td>350 sec</td>
<td>13 sec</td>
<td>27x faster</td>
</tr>
</tbody>
</table>
Secured Delivery System

- Delivery of high-volume data file on HTTPS through III protocol

**Benchmark Result**

- International WAN: Europe/USA - Japan
  - Bandwidth: 10Mbps, RTT: 240ms, Loss rate: 1.0%

<table>
<thead>
<tr>
<th></th>
<th>File size</th>
<th>No. of clients</th>
<th>Without III</th>
<th>With III</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Upload</strong></td>
<td>10 MB</td>
<td>1 pcs</td>
<td>295 sec</td>
<td>11 sec</td>
<td>27x faster</td>
</tr>
<tr>
<td>(Europe-Japan)</td>
<td>10 MB</td>
<td>5 pcs</td>
<td>310 sec</td>
<td>14 sec</td>
<td>22x faster</td>
</tr>
<tr>
<td><strong>Download</strong></td>
<td>10 MB</td>
<td>1 pcs</td>
<td>205 sec</td>
<td>11 sec</td>
<td>19x faster</td>
</tr>
<tr>
<td>(USA-Japan)</td>
<td>10 MB</td>
<td>5 pcs</td>
<td>240 sec</td>
<td>17 sec</td>
<td>14x faster</td>
</tr>
</tbody>
</table>
Delivery of virtual desktop image hosted on datacenter to office

**Benchmark Result**

- **International WAN**: Europe – Japan
  - Bandwidth: 50Mbps, Latency: 250ms, Loss rate: 0.1%

<table>
<thead>
<tr>
<th></th>
<th>Without III</th>
<th>With III</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waiting time</td>
<td>2.3 sec</td>
<td>0.5 sec</td>
<td>4.6x faster</td>
</tr>
</tbody>
</table>

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Access to web application from mobile devices via wireless network

Wireless environment

- Bandwidth: 20Mbps, Latency: 150ms, Loss rate: 0.1%

Benchmark Result

Wireless network

- Bandwidth: 20Mbps, Latency: 150ms, Loss rate: 0.1%

<table>
<thead>
<tr>
<th></th>
<th>Without III</th>
<th>With III</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waiting time</td>
<td>5 sec</td>
<td>1 sec</td>
<td>5x faster</td>
</tr>
</tbody>
</table>

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Technical architecture

- Technical architecture
- Communication flow
- Environment setting overview
- Setting screen sample (Windows / Android)
Technical architecture

- **Protocol Conversion**
  - Convert TCP/IP protocol to high-performance protocol (UNAP, UDP+RPS) at lower layer
  - No need to modify applications

1. **TCP/IP**
   - Client Application
   - Protocol conversion
   - Server Application

   - (1) TCP/IP
   - Proxy address
   - (2) High-performance protocol (UNAP, UDP+RPS)
   - (3) TCP/IP

2. **Network**
   - Data Link
   - Physical

3. **Session**
   - Application
   - Presentation
   - Proxy address

4. **Transport**
   - High-performance protocol (UNAP, UDP+RPS)

5. **Application**
   - II (client-side)
   - II (server-side)
(1) Client Application transmits data to client-side III
(2) Client-side III converts the data from Client application into UNAP or UDP+RPS
(3) Client-side III transmits data to server-side III
(4) Server-side III converts the data from client-side III into TCP
(5) Server-side III transmits data to Server Application
Environment setting overview

**Client Application**
IP: 192.168.2.150

**Interstage Information Integrator (client-side)**
IP: 192.168.2.161

- **[C-1] / [S-1] Service**
  Service ID: Interstage 01

- **[C-2] Receiving Information**
  Machine’s own IP: 192.168.2.161
  TCP port Number: 80

- **[C-3] Sending Information**
  IP (host name): 192.168.2.162
  TCP Port Number (for control): 7100
  Protocol Type: R-TSP
  UDP Port Number (for data): 5100

**Interstage Information Integrator (server-side)**
IP: 192.168.2.162
- **[S-2] Receiving Information**
  Machine’s own IP: 192.168.2.162
  TCP Port Number: 7100
  Protocol Type: R-TSP
  UDP Port Number (for data): 5100
  TCP Port Number (for Rapid TCP): 5100

**Server Application**
IP: 192.168.2.170
- Waiting port: 80

- **[S-3] Sending Information**
  Application Server IP (Domain): 192.168.2.170
  TCP Port Number: 80

- **[A-1] Destination**
  IP: 192.168.2.161
  Port: 80

- **[B-2] Receiving Information**
  Machine’s own IP: 192.168.2.162
  TCP port Number: 80

- **[B-3] Sending Information**
  IP (host name): 192.168.2.162
  TCP Port Number (for control): 7100
  Protocol Type: R-TSP
  UDP Port Number (for data): 5100

- **[A-3] Sending Information**
  Application Server IP (Domain): 192.168.2.170
  TCP Port Number: 80

- **[B-1] Receiving Information**
  Machine’s own IP: 192.168.2.162
  TCP port Number: 80

TCP Port Number: 80
UDP Port Number: 80

TCP port number that is necessary to consider the firewall settings
UDP port number that is necessary to consider the firewall settings
Setting screen sample (Windows)

Basic Setting (client-side)

Basic Setting (server-side)
Setting screen sample (Windows)

Line Setting (Client / Server)
### Service Setting

**Service**
- Service ID: interStage01

**Receiving Information**
- Machine’s own IP: 127.0.0.1
- TCP Port Number: 80

**Sending Information**
- IP (host name): 192.168.2.162
- TCP Port Number (for control): 7100
- Protocol Type: R-TSP
- UDP Port Number (for Data): 5100

### Line Setting

**Line Measurement Cycle (second)**: 30
**Network Bandwidth usage rate (%)**: 100
**Maximum Line speed (Mbps)**: 80.0
**Minimum Line speed (Mbps)**: 0.1
**Encryption**: Not Use
**Send Buffer (KB)**: 32000
**Receive Buffer (KB)**: 64000
**EventViewer/Syslog**: ERROR
**TCP Port Number (for R-TSP)**: 20010
**Rapid TCP**: Enabled
Deployment model

- Proxy environment
- Load balancing environment
- SSL-VPN environment
- Traffic using III needs to detour the proxy server
- Client and server have to communicate without going through proxy
Load balancing environment

- Configuration requiring load balancing
  - Deploy sever-side III in front of a load-balancer

Client-side

Server-side

Client PC recognizes several servers as ‘only one server’

Flexibly balance workload according to the congestion status (round robin, etc.)
SSL-VPN environment

Reference example - Reason for no sufficient result on SSL-VPN

- III converts TCP to high-performance protocol (UNAP, UDP+RPS)
- However, SSL-VPN encapsulates UDP protocol into HTTPS protocol (TCP)
- HTTPS protocol (TCP) causes extra waiting time affecting its RTT
- For this reason, sufficient acceleration cannot be performed
Competitive advantage

III Characteristics
III Characteristics

**Application**
- Optimizes *only the traffic of targeted application in the WAN traffic.*
  - Allows you to optimize *without impacting other traffics.*
- Can select the target application to be optimized.

**Deployment**
- **Software-based WAN optimization solution.**
  - Can be deployed *on virtual environment or existing server without changing any existing network configuration.*
- Configure target application to send traffic to III.
Product lineup

- License scheme
- License model example
- System requirements
## License scheme

<table>
<thead>
<tr>
<th>Product</th>
<th>License scheme</th>
<th>Appropriate for</th>
</tr>
</thead>
</table>
| Interstage Information Integrator Standard Edition | Needs to be purchased per processor on server  
  **Single-core processors**  
  - One processor license is required per processor  
  **Multi-core processors**  
  - Licenses equal to the total number of cores multiplied by the relevant coefficient must be purchased (decimals rounded up) | Datacenter Branch office |
|                               |                                                                                |                             |
| Interstage Information Integrator Client License | Needs to be purchased in line with the number of client devices (Smartphone, Tablet, Notebook) | Mobile users |

<table>
<thead>
<tr>
<th>Processor type</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intel (excl. Itanium)</td>
<td>0.5</td>
</tr>
<tr>
<td>AMD</td>
<td>0.5</td>
</tr>
</tbody>
</table>
License model example

Required Licenses

- Datacenter: 1x PRIMERGY RX100 (4 cores, Xeon) + 2x III Standard Edition Licenses
- Office A: 1x PRIMERGY TX120 (2 cores, Pentium) + 1x III Standard Edition License
- Office B: 1x PRIMERGY TX120 (2 cores, Pentium) + 1x III Standard Edition License
- Mobile: 10x Tablet/Smartphone/Notebook + 10x III Client Licenses
# System requirements

## Hardware

<table>
<thead>
<tr>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Server</strong></td>
</tr>
<tr>
<td>Memory: more than 2GB, Disk: more than 1GB free space</td>
</tr>
<tr>
<td><strong>Client</strong></td>
</tr>
<tr>
<td>Memory: more than 1GB, Disk: more than 50MB free space</td>
</tr>
<tr>
<td><strong>Smart device</strong></td>
</tr>
<tr>
<td>Memory: more than 1GB, Disk: more than 30MB free space</td>
</tr>
</tbody>
</table>

## Operating System

<table>
<thead>
<tr>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Windows</strong></td>
</tr>
<tr>
<td>FUJITSU PC, PRIMERGY, PRIMEQUEST, FUJITSU Cloud IaaS Trusted Public S5, AT compatible machine</td>
</tr>
<tr>
<td>Microsoft Windows Vista, 7, 8</td>
</tr>
<tr>
<td><strong>Linux</strong></td>
</tr>
<tr>
<td>PRIMERGY, PRIMEQUEST, FUJITSU Cloud IaaS Trusted Public S5</td>
</tr>
<tr>
<td>Red Hat Enterprise Linux 6</td>
</tr>
<tr>
<td><strong>Solaris</strong></td>
</tr>
<tr>
<td>SPARC M10, SPARC Enterprise, PRIMEPOWER, S Series</td>
</tr>
<tr>
<td>Oracle Solaris 10, 11</td>
</tr>
<tr>
<td><strong>Android</strong></td>
</tr>
<tr>
<td>Smart device equipped with Android</td>
</tr>
<tr>
<td>Android OS 4.0, 4.1, 4.2</td>
</tr>
</tbody>
</table>
shaping tomorrow with you